"WRITTEN SO YOU CAN UNDERSTAND IT."

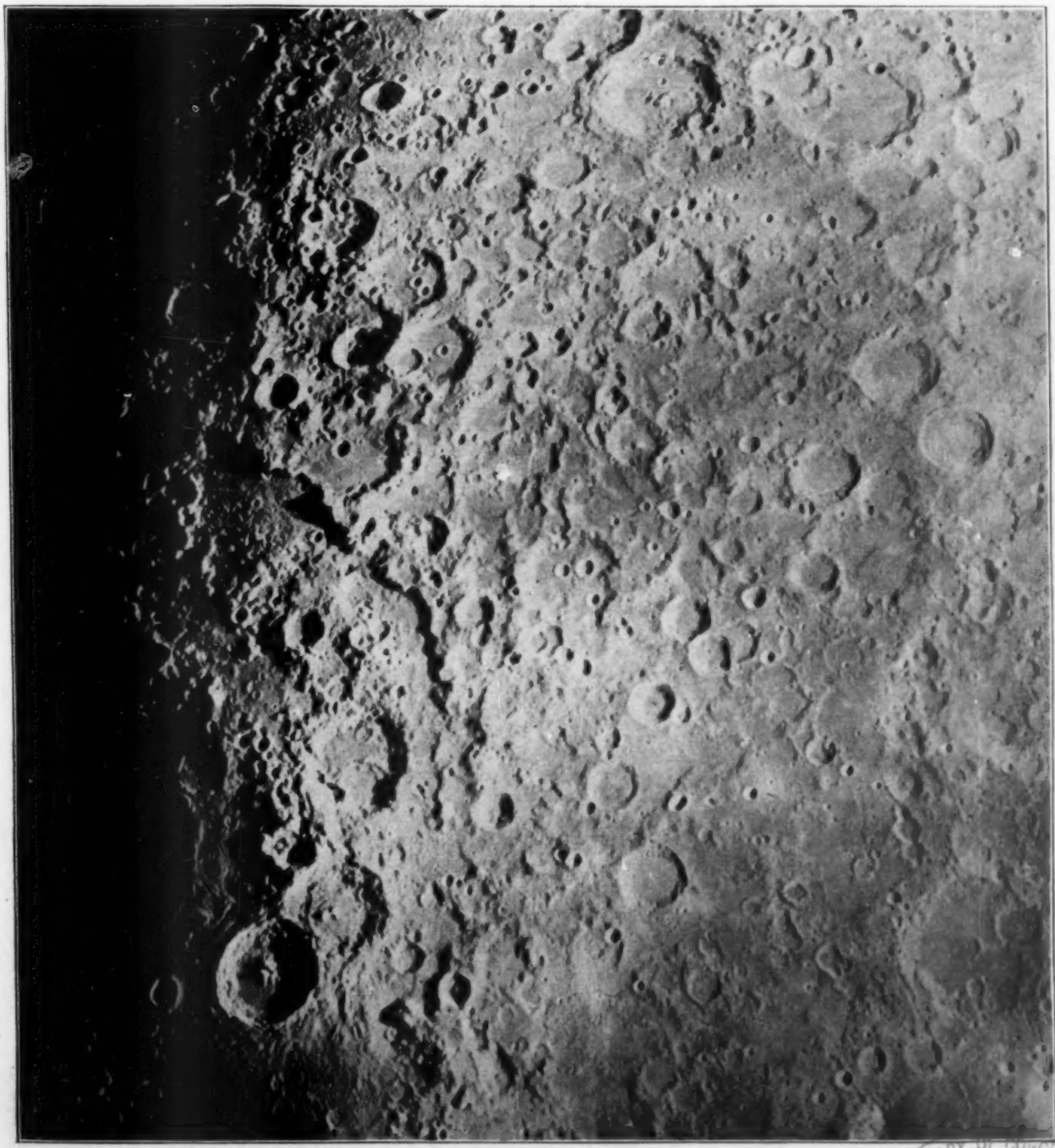
POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

VOL. I. NO. 7. CHICAGO, FEBRUARY 22, 1902. PRICE 5 CENTS.

LATEST PHOTOGRAPH OF THE MOON

BY THE LARGEST TELESCOPE IN THE WORLD



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THE MOON AND ITS GIANT VOLCANOES.

Objects Revealed by the Most Remarkable Picture Ever Obtained—Description of the Process of Photographing Other Worlds.

Probably the most remarkable photograph of the moon ever obtained has just been taken with the 40-inch telescope of the Yerkes observatory, at Williams Bay, Wis., the largest telescope in the world. More vividly than it has ever before been depicted the enormous volcanic crater, Theophilus, appears in such plain view that one might almost fancy it the mouth of an extinct volcano of the earth, viewed from a balloon through a telescope. But when it is realized that this crater is 64 miles in diameter and three miles deep it is somewhat easier to comprehend that the photograph is of an object 238,840 miles distant from the camera. The crater is shown in the lower left-hand corner of the picture on the front page.

The picture shows that the whole surface of the moon is spotted with these craters and that the satellite was once the scene of wonderful disturbances. It appears to have been a boiling mass of volcanoes unlike anything known to our world. It is almost impossible for one of earth's inhabitants to imagine a volcanic crater with a diameter that would extend across Lake Michigan between Chicago and St. Joe. These remarkable disturbances are probably due to the differences of attractions of the two surfaces. A man on the moon would weigh one-sixth of what he does on the earth. This important fact, says the Astrophysical Journal, should be borne in mind while studying the surface formation of the moon, occasioned probably by volcanic force of surprising magnitude, in some very remote time in past lunar history.

These remarkable things are seen on the earth's side of the moon. What is on the other side has never been determined. It has never been seen by astronomers and is constantly hidden from view. Will some Roentgen of 1,000 years hence devise some kind of an astronomical X-Ray machine that will reveal to us the mysteries on the other side of this most interesting of celestial objects?

The region of the moon shown in the photograph, of which we give an accurate reproduction, is in the southwestern quarter of the circumference.

The ragged white specks and streaks fringing the picture on the left and resembling sunlit islands in an inken ocean, are the high-reaching peaks of great mountains. The black intervening is the shadows in yawning valleys. All about may be noticed the huge shadows bordering the mountains and in the craters of volcanoes. They are, of course, more distinct toward the left because of the greater obliquity of the sun's rays, occasioned by the curvature of the surface, which gradually disappears.

"The dark part," says Prof. Geo. E. Hale, who has charge of the great observatory, "is toward the west and has been recently overcast; that is to say, the night is creeping over the face of the moon and will soon creep over Theophilus. Along the terminator can be seen particularly high peaks with a sunlight still illuminating them."

The picture shows no sign of any habitation of creatures like or unlike those that dwell on the earth. The orb has practically no atmosphere; no water; no clouds; no storms. It is a changeless solitude.

The telescope with which this photograph was taken is by far the largest ever devised by human ingenuity and mechanism, and has caused all the world to wonder at its magnitude and consequent achievements. It was constructed by Alvan Clark & Son, the famous American firm. The diameter of the object glass of the refractor spans 40 inches. Its nearest rival is the Lick telescope with a 36-inch refractor; next is the Lowell 24-inch. One great advantage it possesses is permitting micrometrical measurements with great ease and absolute certainty.

The photographer whose subjects are other worlds thousands and millions of miles away has a far more difficult task than the one who photographs human faces and objects of this world. In describing the process of taking photographs with the aid of this wonderful telescope, Prof. Hale said:

"The 40-inch telescope was origianlly intended for visual work only, but it has only recently been adapted by Mr. W. R. Ritchey so that it can be used as a photographic telescope as well. When used in this way the telescope tube becomes the camera box. A plate-holder is placed at the lower end. Just in front of the sensitive plate is placed a yellow screen to cut off all rays except those that the lens is corrected for—the visual rays. The exposure given is about one-half second. The brightest parts of the moon are partially screened off so as to give a chance for the less bright parts to be fully exposed. A favorable moment, when the image of the moon appears to be steady, is watched for, and several exposures are made of the same phase so as to insure at least one perfect negative."

Prof. Ritchey said: "The results obtained in this work demonstrate the effectiveness and importance of telescopes of given local length for the photography of objects requiring great scale and separating power.

"It seemed highly desirable to find, if possible, some way to utilize for such photographic work, the great power of the 40-inch visual telescope. In November, 1900, a number of thin, plane-parallel plates of glass were prepared and coated with collodion of a delicate greenish-yellow tint, which, when tested with the spectroscope, was found to effectually shut out the blue end of the spectrum, while transmitting the green, yellow and red without appreciable diminution of intensity. Several very perfect color screens of excellent quality and of different densities were thus secured for preliminary trials. A special plate-holder was constructed, the color-screen being mounted in the plate-holder, in contact with the sensitive plate. Cramer's isochromatic plates were used, these being extremely sensitive to yellow light, while their sensitiveness falls off rapidly in the orange and red, on the one side, and the green on the other, increasing again in the blue.

The full aperture of the telescope was used and the time of exposure was about one-half second.

HEAT FROM THE EARTH AS A SOURCE OF POWER.

Wonderful Possibilities Follow the Invention of the Sulphur Dioxide Engine.

The invention of the sulphur dioxide engine, which is said to increase the power of steam, as told of in a previous issue of Popular Mechanics, has led to discussion on the possibility of utilizing the heat of the earth's interior as a source of power.

The earth is 8,000 miles in diameter and except for a thin shell is probably hotter than any furnace yet devised by human skill. Estimates differ as to the thickness of this crust. Temperature increases with descent in mines and oil wells at an average of one degree for every 50 or 60 feet. Assuming that the mean for the earth's surface is something like 50 degrees above zero, the boiling point of water, 212 degrees would be reached at a depth of about 8,000 feet Between 30 and 60 miles down the heat is sufficient to melt the hardest known substances, clay, lime, carbon and the like. At this distance temperatures of 5,000 and 6,000 degrees probably exist.

Prof. Thos. C. Mendenhall in Cassier's Magazine says that the heat of the earth's interior is a matter of the greatest interest and opens infinite possibilities. It is claimed that a sulphur-dioxide engine might be run successfully at a depth of a mile which has more than once been attained by oil wells.

A new train which has been started between Paris and Calai is said to be the fastest in the world. It covers the distance in three hours, including a four-minute stop at Amiens.

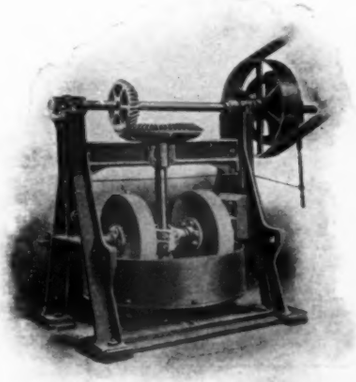
CARBORUNDUM.

What It Is—How Made—For What Used.

Carborundum is not found in nature. It is an artificial product discovered by Acheson in 1891. It is made of ground coke, sand and salt burned in an electric furnace of great power. It is used for grinding and polishing and has taken the place of emery to a large extent. It is slightly heavier than sand, is almost as hard as diamond, but not as tough.

The first carborundum produced was very expensive, the product of the small furnaces being but one-quarter pound per day. Now the Carborundum Company, of Niagara Falls, to whom we are indebted for much information, turns out 25 tons daily.

The crude materials are clean sand, sawdust, salt and coke. The coke is ground,

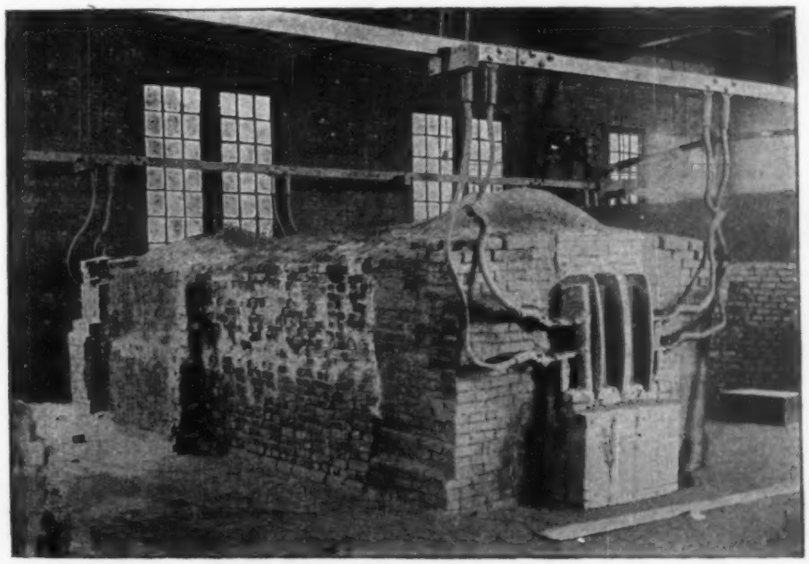


THE GRINDER.

some of it to kernels to be used in making the "core," the rest to a fine powder. This powder is weighed into a mixer, with proper proportions of the sand, salt and sawdust, and mixed by machinery.

In the furnace room are 14 furnaces built of brick, oblong in shape, and each 16 feet long, 5 feet high and 5 feet wide. The ends are two feet thick and are not often disturbed. The rest of the furnace is built up for each firing. Each end supports the "terminals" consisting of 60 pieces of carbon 30 inches long and 3 inches diameter. These carbons are connected with copper rods to which electric wire can be attached. When the furnace is ready to fire the electric current enters one end through the wires and carbons and finds its way through the core to the carbons at the other end so back to the generator. In doing so an enormous amount of heat is created because the core is a poor conductor of electricity and like a man fighting his way through a crowd—gets hot. The furnace is in reality a tremendous arc-light, only the light is concealed by the brick covering. If a person should look at it many moments it would blind him. The workmen wear colored glasses when they must look in through the small peep hole.

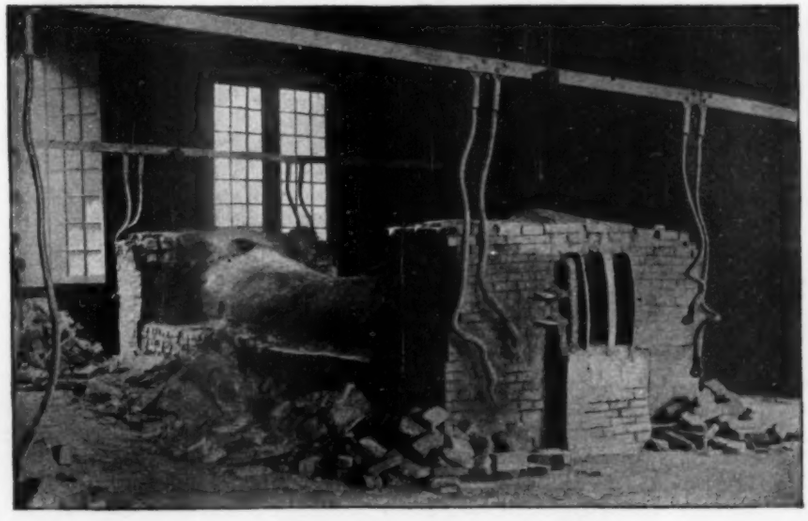
To fill a furnace the side walls are built up four feet, and the mixture thrown in until the furnace is half full. Next a



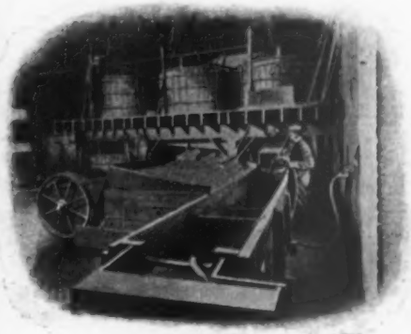
CORBORUNDUM FURNACE BURNING.

trench is made in the mixture about 10 inches wide and deep from one set of carbons to the other. In this is placed the core: 1,100 pounds if new, 850 pounds if previously used. This core is the kernels of coke already mentioned. It is then rounded by hand until it lays, lengthways like a round post, 21 inches in diameter. More mixture is now heaped on until the furnace is full and containing about 8 feet deep of mixture. The side walls are then finished. The wires are connected and the current turned on.

The electric current is generated by power from Niagara Falls, which comes to the works at 2,200 volts. This is too strong and it is passed through a transformer and reduced to 185 volts. Of the 1,000 horse-power which enters the transformer 40 horse-power is lost in the transforming. Water is constantly pumped



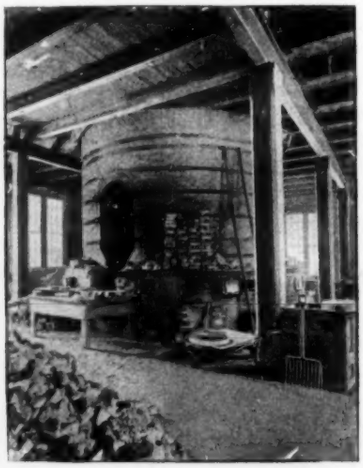
CARBORUNDUM FURNACE AFTER BURNING.



WHERE CARBORUNDUM RECEIVES ITS CHEMICAL TREATMENT...

through coils of pipe to keep it cool. In the furnace a new core takes longer to heat up than an old one on account of its impurities which soon burn out. As the furnace becomes heated, gases escape through the loose walls. Five and a half tons of gas must escape before the process ends. Sometimes the gas generates faster than it can escape; then there are explosions.

The purpose of the sawdust in the mixture is to give the gas a chance to escape, as the sawdust quickly burns out and leaves



A SECTION OF THE KILN ROOM.

the mixture porous. For 36 hours the electric current of 1,000 horsepower passes through the furnace. Then it is cut off, the furnace cooled, the side walls and top removed. A strong crust must be broken with big steel bars. Within, surrounding the core, are great lumps of crystals of most brilliant colors, chiefly blue and green. These are carborundum crystals, which are removed, taken to a crusher and ground, then to tanks where a treatment with diluted sulphuric acid lasts several days. They are then washed, dried and graded to size by sieves. Some are

THE 1500-TON HYDRAULIC PRESS.

ground to extreme fineness and called flour; this is used for delicate polishing. The coarser is made up like sand paper, and used in many other ways.

The chief use of carborundum, however, is for the heavier work of grinding and polishing iron, steel, stone, etc., for which purpose it is made into bricks or wheels of an infinite variety of sizes and shapes. The wheels range all the way from one a dentist uses in smoothing out the cavity of a tooth to large wheels for truing car wheels and the rolls of rolling mills. To make wheels the carborundum is mixed with kaolin and feldspar, moulded in hydraulic presses into shape, then baked like pottery in a kiln.

Experiments with the furnaces in which carborundum is burned lead electricians to expect they will soon build furnaces in which the heat will be but little less than that in the sun itself.

MUMMY CATCHES FIRE AND CREATES BEDLAM.

Final End of the Eventful Career of a Priest's Daughter Who Died Centuries Ago.

Great excitement was caused in the divinity school of the University of Chicago last week by an Egyptian mummy which had remained harmlessly in its encasements for centuries. The mummy was that of the daughter of a priest, who is said to have led an eventful career in ancient Eygpt during her lifetime, but whose power to create excitement was thought to have terminated some time during the reign of the Ptolemies. The mummy caught fire, and before it could be extinguished the whole divinity school was turned into pandemonium. How the fire started is a mystery. The mummy was lying seemingly harmless in a pile of other curiosities in the basement of the Haskell Oriental Museum. The first intimation was a strangely pungent and stiffling odor, that filled the rooms above, where the students were at work, and drove the occupants into the halls. The mummy was discovered blazing merrily on top of the other curios. A cry for help went up and after hard work for nearly half an hour, in which all the fire apparatus of the institution was brought to play, the fire was extinguished. The mummy, however, was left a wreck and nothing but ashes remain to mark the end of the once noted daughter of an Egyptian priest.

TAKES BRAINS TO FIRE.

Professor W. F. M. Goss, of Purdue, has recently reported a case which shows how great may be the difference in the efficiency of different firemen, says Electrical Review. In a test of a pumping engine extending over seventy-two hours, the boilers

CARBORUNDUM WHEELS.

were fired by different firemen, each working a "watch" of eight hours. The load on the engine and other conditions were practically constant through the run, yet the worst fireman used twenty-five per cent more fuel during his watches than the best one did.

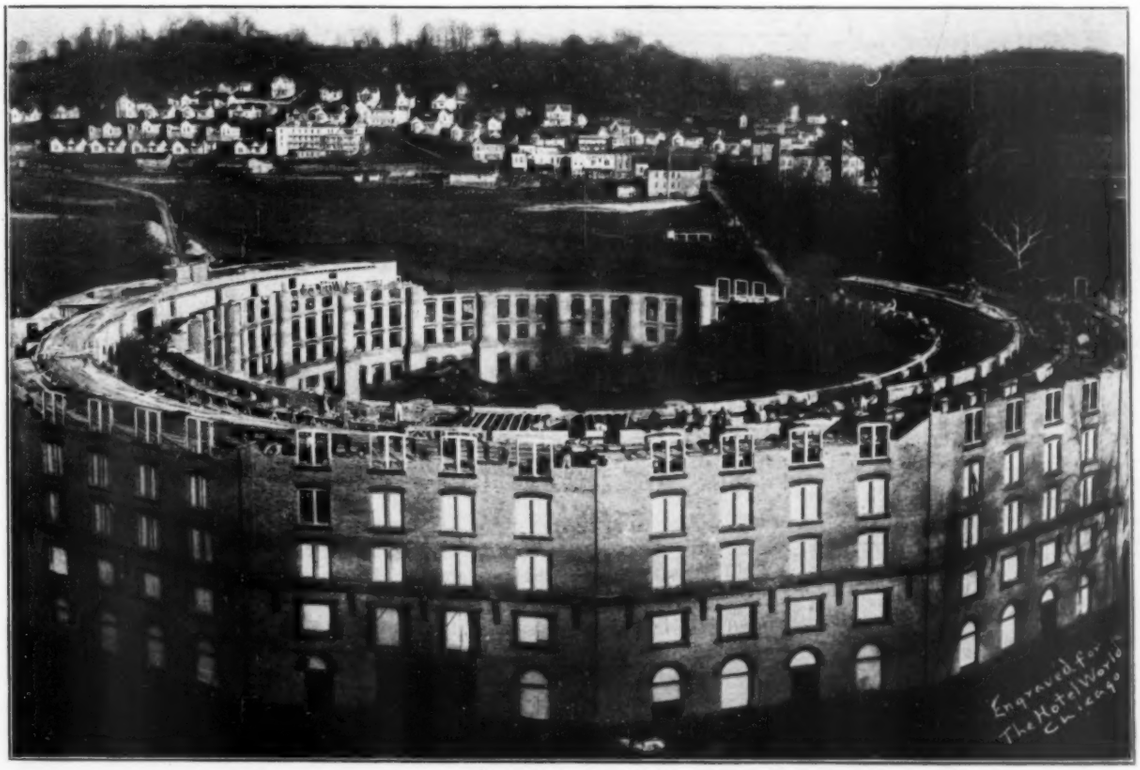
A guest at a Vienna hotel where he had stopped for weeks, gave a gratuity of six florins to the head porter. The latter demanded ten and locked up the guest's baggage when it was refused. The court decided that the guest must pay in order to recover his baggage as the hotel did not allow wages to its porters or waiters.

REMARKABLE HOTEL BEING BUILT IN INDIANA.

Different From Anything Ever Attempted Before—Great Glass Dome on Top.

Unlike any other hotel ever attempted in any land is the new hostelry now in progress of erection at West Baden, Ind. It is a multi-sided structure of oval interior and is to be crowned by an enormous glass dome, 200 feet in diameter. The dimensions of the building on the ground are, 634 by 343 feet.

Contrary to the natural supposition, says the Hotel World, the rooms in the hotel will be square or oblong of regular form. This is accomplished by employing the wedge-shaped space that naturally results from the circular form, for bath rooms, closets and washbowls. This will mean a great advantage, not only in the symmetry of the rooms, but convenience in furnishing and laying carpets.



ODDEST HOTEL IN THE WORLD.

The photograph from which the accompanying illustration is made, was taken when 500 men were at work on the building. The hotel is being built for Lee W. Sinclair on the site of his hotel that was recently burned. He suggested the plans and the design was drawn by Architect Harrison Albright of Charleston, W. Va.

A London company which insures against smallpox is doing a land-office business. Policies of £1,000 and £2,000 are frequently written.

It is said that the Kaiser would have sent his eldest son, the crown prince, to America, instead of Prince Henry, but for fear he would fall in love with an American girl.

The regular reader of Popular Mechanics need never be at a loss for entertaining things to talk about.

LAKE SUPERIOR IRON SOON TO BE EXHAUSTED.

Warning Sounded Against the Policy of Wasting Low Grade Ores.

According to the argument of C. R. Van Hise of the United States Geological Survey the ore-supply of the Lake Superior Iron region, will be exhausted in the first half of the Twentieth Century. He deplores the policy of wasting the low grade ores for, he says, they are a resource which will certainly have a value in the future. "All of these things," says the Iron Age, "are of very great interest to the South, and indicate that the advantages of that section are to become more and more pronounced as compared with other iron-making districts."

Mr. Van Hise says that the ore bodies of the Lake Superior region cannot be expected to extend beyond the depth to which the descending waters may bear oxygen and percipitate iron oxide. "Up to the present time," he says, "all but an insignificant fraction of the ore has been taken above the 1,000-foot level. Many ore deposits, before reaching the depth of 1,000 feet, have become smaller and poorer, and a number have been worked out.

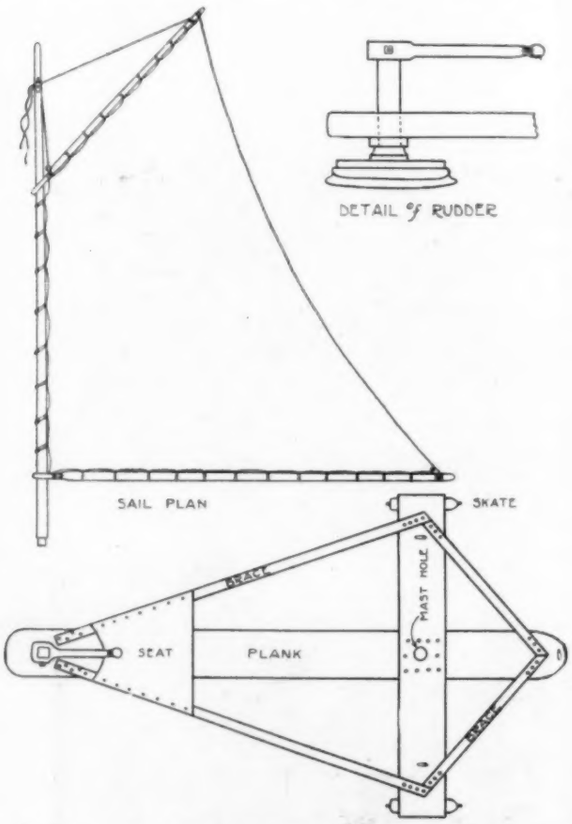
"Thirteen years ago practically all of the material shipped from the Lake Superior region contained more than 60 per cent metalic iron. For the last five years considerable quantities have been shipped containing from 40 to 50 per cent.

"The policy of mining only the richest ores which can be marketed today, and frequently in handling this material in such a manner as to make it difficult to recover the somewhat lower grade material at a later date, is very short-sighted policy, even from the point of view of the mining men, and, and ignoring the future of the nation. The exhaustion within a few decades of the high grade ores of the Lake Superior region now discovered is little short of a certainty.

HOW TO MAKE AN ICE BOAT.

Simple Device That a Child May Construct and Operate.

With the aid of old skates, pieces of board, and an old sheet or a small bit of canvass, a boy possessed of ordinary mechanical genius may make an ice boat for himself that will afford a great amount of sport. The frame of the boat should be made something in the form of a kite. The center board should be four or five feet long, six inches wide and two inches thick. The cross board may be of a piece of 1 by 6 inch plank 3 feet long. Fasten these with braces of small, stout strip, as shown



in the picture, and screw the cross piece securely to the center board. Bore a hole in the center of the intersection for the mast pole. The seat may be made of a piece of strong cloth or leather. Three skates are fastened one to either side of the cross-board and one to the rear end of the center-board, the latter of which is to operate as a rudder. In attaching the skates first make a couple of runner blocks, each 6 inches long and 3 inches wide. Bore holes in them for the straps of the skates to pass through and fasten them securely. Nail the runner blocks firmly to the cross-board about 1½ inches from each end.

In making the rudder hew down a piece of scantling, one foot long, until it assumes the shape of a club with a flat base. Nail a strip of wood firmly to this base and to the strip fasten the skate. Run the top of the club through a hole bored in the stern of the center board. Then make the helm by boring a hole in one end of a strip of soft board about one foot long and through this hole pass the club or rudder-pole and fasten it so it may be shifted when desired. Make the sail out of an old sheet, if it be strong enough, piece of canvass, or any such substance and attach it to the mast and sprit, as shown in the illustration, and guide it by a stout string attached to the lower outer corner. As an ice boat will travel faster than the wind, some care and considerable skill is necessary. Unless you are accustomed to managing a sail boat do not select a place in which to learn where there are air holes or open water. To stop the boat throw the head around into the wind, same as you would with a sail boat. If the wind is strong the occupants of the boat should lie flat on their stomachs.

NEW YORK'S FLOATING POSTOFFICE.

An Equipment to the City's Mail Service Unknown to But Few.

For five years New York has had in its harbor a fully equipped floating United States postoffice, yet few residents of the metropolis are aware of this fact, save those who are employed in the distribution of incoming European mail. It is a steamboat named the "Postmaster General", and was placed in service in 1897 by Postmaster Cornelius Van Cott. Mr. H. L. Joyce in a paper read before the New York Railroad Club said:

"This steamer meets all the incoming European mail steamers down the lower bay, takes the foreign mail from them during the trip to Quarantine, and, as fast as it is landed on the Postmaster General, a corps of clerks on board assort it. By the time that this boat reaches her pier in this city all the foreign mail for other cities has been assorted, as well that for the different sub-stations in New York City. Mail wagons are waiting the arrival of the Postmaster General at her pier, the assorted mail is quickly loaded, the local mail being rushed to the post office and mail for other cities sent direct to the railroads without going through the General Postoffice as formerly; in the majority of cases the mail for New York City is in the hands of its consignees and read, and mail for different cities is in transit by the various railroads before the steamer that brought it to this country is docked at her pier."

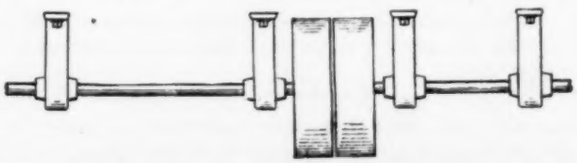
FIRST DISPATCHER OF TRAINS BY TELEGRAPH.

A. W. Copeland of Chenoa, Ill., claims to be the first dispatcher of trains by telegraph. He transmitted an order for the movement of a train in 1852. Previous to that time train dispatchers were not considered necessary and the telegraph was used for commercial purposes only.

Copeland was employed at the postoffice at Rutland, Vt., which was also a telegraph office. There was a snow blockade on the Rutland & Burlington, one of the first roads constructed in New England. Copeland learned that the south bound train was delayed and was told that the conductor of the north bound train was waiting at a siding for its arrival. He suggested that he could wire the waiting conductor for a new meeting point and the suggestion was carried out. This was the beginning of train dispatching. Afterward conductors, by means of the telegraph, arranged meeting points to suit the exigencies of traffic. Several years later dispatchers were employed to relieve the conductors of this duty. Copeland was born in Middleburg, Vt., June 7, 1830.

ABOUT LOOSE PULLEYS.

A contributor to the Wood Worker has this to say regarding the loose pulley: Put the tight pulley on the end of the shaft.



Put the loose pulley on another shaft, and when the machine is idle, let this loose pulley shaft turn, instead of remaining idle. Where there is room this method does away with the loose pulley. The belt can be shifted just the same.

Popular Mechanics

H. H. WINDSOR, Publisher

Journal Building, - - - Chicago

SUBSCRIPTION

United States, Canada, Mexico and all U. S. Possessions, per year ***$1 00***

Foreign Countries, post paid ***2 00***

Advertising rates, $2 per column inch per issue.

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POPULAR MECHANICS

Journal Building, - - Chicago

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AMERICA'S ENORMOUS CONSUMPTION OF TIMBER.

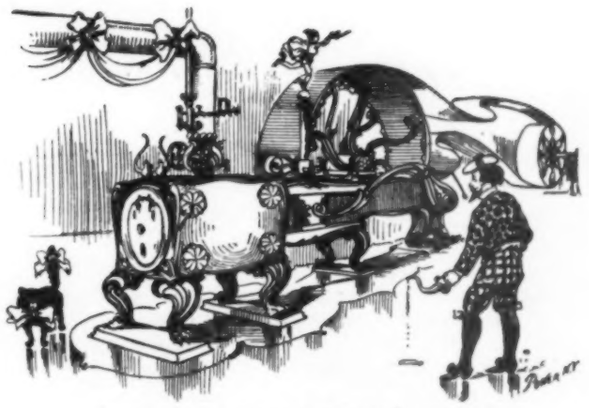
Four Million Feet Used Annually for Matches—Eight Times That Much for Shoe Pegs.

Forty billion feet of lumber is yearly used by the United States for the lumber and paper trade. This is equivalent to the product of about 4,000,000 acres of good virgin forest, an area equal to Rhode Island and Connecticut combined. This does not include the wood used for fuel, which is about 4½ times more. Four million feet is used for matches, the product of 400 acres of good virgin forest. About 620,000,000 cross ties are now laid on American railroads, and 90,000,000 new ties are required annually for renewals, which are equal to 3,000,000 feet of lumber. There are now standing nearly 7,500,000 telegraph poles and 750,000 new poles are required each year for renewals. These figures do not include telephone poles and the poles required on new railway lines. The timber used for ties and poles each year is equivalent to the product of 100,000 acres of good virgin forest. The amount of wood used in a single year for making shoe pegs is equal to the product of fully 3,500 acres of good second growth hard wood land. Lasts and boot trees require at least 500,000 cords more. Most newspaper and packing paper is made from wood. The total annual consumption of wood for paper pulp is equivalent to more than 800,000,000 board feet of timber, equal to the growth of 80,000 acres of prime woods.

THE OLD WORLD IS NOW INDUSTRIOUSLY THE NEW.

Industrially it is no longer the Old World. It is New Europe and Old America! It is New Europe, a land of undeveloped possibilities, abounding in opportunity for keen captains of industry. It is mature America, the exemplar of modern industrial methods, perfected mechanical ideas, and ripe economic policy, says Scribner's.

This conception of a new Europe, looking toward mature America for the best illustrations of industrial development, was novel enough when I first encountered it, but it becomes familiar as one goes from country to country and sees field after field rich in opportunities for the introduction of better methods, the application of better mechanical ideas, and the planting of more correct economic policies. It was in Rome that I first met this thought of a new Europe. I was told that Italy was but thirty years old, that the present economic life dates back only to 1870, and that the modern Roman is today an industrial pioneer in a virgin country. Such a thought applied to almost the oldest European civilization is especially striking, but every other country of Europe offers illustrations of the truth of the paradox. We not only find that Italy has suddenly awakened to the possibilities of conserving the force of her enormous water power, and is beginning a great movement to turn into electrical energy numberless cascades and rapids, but an examination of the industrial side of every other nation shows much that is still unhewn and unwrought. Austria has just formulated a legislative plan for a great net-work of canals which will cost hundreds of millions of florins and revolutionize the transportation of the empire.



"THE ARTISTIC IN ENGINEERING."—POWER.

TENSION IN BAND SAWS.

Tension in band saws signifies the expansion of the metal throughout the central portions of the blade, so as to stretch the outside edges and particularly the back edge, says a writer in Wood Worker. A saw when strained on the wheels must be the tightest on the cutting edge, so as to not let the saw run in or out of the cut. The speed of band saws has very little to do with the tension, although it has much to do with the work and life of the saw; either too much or not enough speed will have similar influence in inducing cracks. Some band saw filers believe a band saw must not be open closer than an inch or an inch and a half from the edge. They claim a saw will crack if it is opened any closer than an inch from the edge. My saws are opened from edge to edge, and I am not bothered with any cracks; but I find that if a saw is open from edge to edge the tension must be put in evenly. If a saw is wide open and the tension not even the saw will chatter in the cut and is most likely to come off the wheels, cracked. It is well known among practical band saw men that a band saw will not do good work without tension. The back of a saw must be looked after as well as the tension. The back of a saw should be crowned so as to not allow the cutting edge to dodge and make snaky lumber. I find that a saw crowned about 1/32-inch in every five feet gives good results where the wheels are in good shape and in perfect line.

The strongest animals exist entirely on vegetable food. The lion's ferocity, rather than his strength, makes him formidable. An elephant is a match for several lions, and is a vegetarian. The animals with most speed and endurance—the horse, the reindeer and the antelope—are also vegetarians.

Baby carriages propelled by electricity are in use in Paris.

Popular Mechanics is "written so you can understand it."

Easy Electrical Experiments

FOR BOYS.

CHAP. VII.

A SIMPLE ELECTRIC MOTOR.

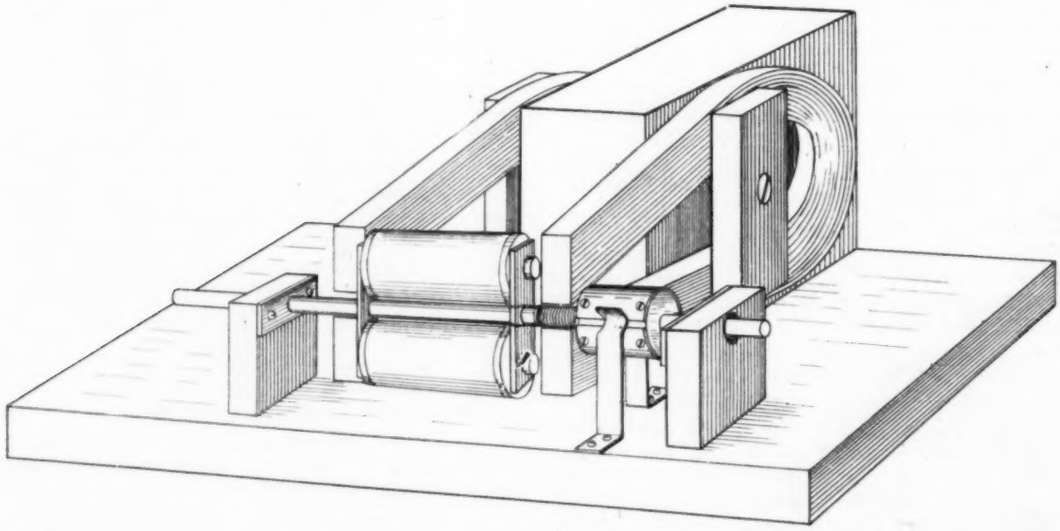
An electric motor has three essential parts. These are (1) a magnet capable of furnishing a powerful magnetic field; (2) an armature, turning in this field, carrying the current which drives the motor; and (3) a commutator for leading the current into the revolving armature. In the simple motor about to be described, the first of these, the field magnet, is made of two 6-inch horseshoe magnets, such as may be bought for about twenty-five cents each. The armature consists of two simple coils, and the commutator is simply a cylinder of brass, split lengthwise into two sections.

To make the armature, proceed as follows: From a rod of soft iron ¼ inch in diameter cut two pieces 1¾ inches long. Wrap each one with a layer of stout paper, gluing it smoothly in place. Upon each wind a coil of No. 24 double cotton covered magnet wire, each coil being 1½ inches long and ¾ inch in external diameter. These coils may best be made by making wooden heads, ¾ inch in diameter, for the end of the coils, with a hole in their centers of such size that they will fit tightly upon the iron core. Drive them on to the iron core so that they leave a clear space at each end of ⅛ inch. Then wind the space between them with wire as just explained. Great pains must be taken to have both spools evenly wound and of the same size and weight. Take a piece of brass rod 3-16 inch in diameter, 6 inches long, and perfectly straight. This is for the shaft. Cut from a piece of brass 1-16 inch thick two pieces, each 1½ inches long and ½ wide. Bore three holes in each. The first of these holes is at the center and is 3-16 inch in diameter. The other two holes are ½ inch each side of the center and are ¼ inch in diameter.

Having made the coils as directed, mount them upon the shaft, as shown in the figure. The two brass strips are slipped upon the shaft, and with the latter passing through the center holes and the iron cores slipping into the outer holes in each. Press the strips tightly against the coils, and solder the strips firmly to the brass shaft, thus fastening the coils firmly to the shaft and in the middle of the latter. Connect one terminal of one coil to one terminal of the other in such a way that the current will go around one coil in a direction opposite to that in which it goes around the other. Leave the remaining two ends hanging free for the present.

The commutator should next be made. To do this mount tightly upon the shaft a block of hard wood ¾ inch long and ⅝ inch in diameter. This wooden cylinder revolves with the shaft. It should fit the latter tightl and its outer end is ½ inch from the end of the shaft. Take a thin piece of sheet copper and bend it into the form of a hollow cylinder ¾ inch long, of such size as to just fit upon the wooden cylinder upon the shaft. Fasten it there with eight of the smallest brass screws obtainable. These screws should be equally spaced, four on each end, and on no account should they be long enough to strike through and touch the shaft, as this will spoil the commutator. After this cylinder is in place, cut it with a file into two equal sections, with the spaces dividing these sections running the same way as the shaft. The two sections must be entirely separated so that there is no electrical connection between them.

Wrap the shaft between the commutator and the coils with a layer of thin paper, and run each of the two free ends of the coils to a section of the commutator. Between the commutator



and the coils these wires should lie close against the shaft, but separated from it by the layer of paper just mentioned, and separated from each other. They should be tightly bound to the shaft by close wrappings of fine silk thread. The appearance of the finished armature is shown in the figure.

The field magnets are two 6-inch horseshoe magnets, such as may be easily secured. Be sure and select two which have at least ¼ inch clearance between their poles. The shaft just described has to revolve in the space between the poles, and this will be a difficult matter to arrange if the magnet poles are closer together than ¼ inch. Indeed, it may be necessary to file the shaft a little at the points where it passes between the poles, in order to allow the shaft to turn freely when the conducting wires are in place upon it.

To support the magnets, fasten a block of wood to a suitable base board, the dimensions of the block being 3 inches by 1⅞ inches by 4 inches. The block should be placed with its narrow face even with the edge of the board, and with the long axis of this face in a vertical position. Fasten the magnets to the slides of this block by cleats, held on by screws, thus enabling us to vary the position of the magnets until they are exactly right, when by tightening the screws they will immediately be clamped in place.

Support the armature as shown in the picture between the poles of the magnets. Two precautions are necessary. First, be sure that the north pole of one magnet and the south pole of

the other are uppermost. This can be determined by trial, although the north pole of a magnet is usually stamped "N." Next, be sure when the coils are so placed that one is directly above the other that the commutator is so fixed upon the shaft that the two slots are horizontal.

The supports for the shaft may be made of two blocks of wood. A piece of brass screwed to each, with a hole just large enough to allow the shaft to turn freely, will make a fairly good bearing.

Fasten two springs of very thin brass to the base board, and adjust each until it bears firmly upon the commutator. Upon connecting the two brushes to a battery of four or five bi-chromate cells, the motorss will revolve very rapidly and with considerable power.

WILL WIRELESS TELEGRAPHY BECOME PRACTICAL?

Serious Doubts Raised by English Electicians.

Now that the first excitement over Marconi's experiment in trans-Atlantic signaling has had a chance to cool a little, profound electricians are pointing out some difficulties of which we had not been told. The Electrical Review, London, editorially suggests some of these.

First, the present masts, of which a large number are required, are 130 feet high, and cost $1,200 each. These would in actual practice be replaced by higher and more expensive steel towers. This, however, is no great obstacle.

Sir Henry Mance says, that it must be perfectly clear to anyone that wireless telegraphy has come to stay; that it will be extremely useful in certain cases, but he declines to believe that it will ever be a commercial rival to an submarine cable of moderate length. No individual or company can monopolize the ether; the systems failed during the yacht races in New York because neither station would give way for the others, and he believes somewhat similar results have been observed on board His Majesty's fleet when experimenting with wireless telegraphy. He does not doubt that some sort of signal was received by Mr. Marconi during his recent experiments on the other side of the Atlantic, but he mentions, for the information of those interested, that the earth current variations in a long submarine cable frequently produce a signal resembling the letter "S." The selection of this letter by Mr. Marconi for use in his experiment was, therefore, rather unfortunate. The dream of our philosophers of old has been realized, concludes Sir Henry, but whether there is any money in it is quite another question.

Another expert claims no international law could avoid interference of one line with another, and adds:

"If for the moment we reverse the situation and assume that wireless telegraphy was originally introduced, so that we had for the last fifty years known no other method, I am confident that the invention of submarine cables, with their direct connection, consequent privacy, and ease of working, would be hailed as an enormous advance and improvement upon the older method."

Mr. Rymer-Jones, a leading cable expert, says wireless telegraphy has a large and useful field in military, naval and isolated lighthouse work, but it cannot work as fast as cable. The latest Atlantic cables transmit forty-five words a minute on the simplex system, and ninety words duplex, while the best work in wireless systems has been only twenty-four words a minute on short lines.

However, when Marconi has had as many years to perfect his plans as have ocean cable operators, perhaps he may outdo them all.

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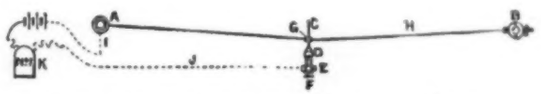
AUTOMATIC FIRE DETECTOR.

A new method of announcing the occasion and location of fire in buildings has been patented in England, and is described in the Electrical Times, London. Instead of employing a mercurial instrument in each room, a copper or silver wire



Method of Fixing Wire, showing Contact-making Device.

is stretched along one side of the room. When fire occurs the heat causes this sensitive wire to expand and sag, and in doing so closes an electric circuit, which gives the alarm.

Our cut shows the alarm board for a small hotel.

OFFERS HIS BODY FOR VIVISECTION.

Doctor Would Let Surgeons Cut on Him for a Year, if He Live That Long.

Dr. James E. Russell, of Brooklyn, has offered to let surgeons cut him up alive for the benefit of science. Over his signature he invites the profession to use his body as a subject of vivisection for one year's time, or until death, if he succumb to the experiments before the expiration of twelve months. He states that his sole object in making this unparalleled offer is to further scientific knowledge and to silence what he terms "the rant anti-vivisectionists." In his offer the doctor says:

"I will place no restrictions upon any operation. I would merely suggest that the experiments be so arranged that those organs which have the most immediate results on the maintenance of life be reserved until last, in order that usefulness of my body may be prolonged and enlarged."

The doctor's wife has taken steps to prevent him from carrying his plans into execution. New York has several good asylums for the feeble-minded.

A North Dakota merchant has his clerks drive out in the country and visit the farmers, as a means to getting acquainted and building up trade.

COMPRESSED AIR SOLVES PROBLEM OF WATER SUPPLY.

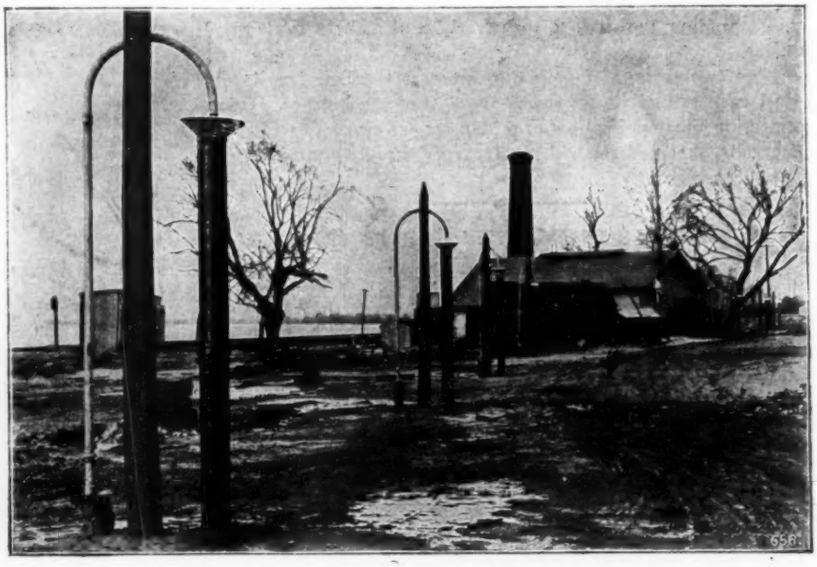
System Installed in the Government Hospital for the Insane a Gratifying Success.

Compressed air has solved the much mooted problem of furnishing a sufficiency of pure water for the government hospital for the insane at Anacostia, D. C. The air lift system which has been recently installed has insured an abundant, permanent and unfailing supply of the purest quality of water at the least expense. The buildings of the hospital stand on the brow of a hill overlooking the city of Washington.

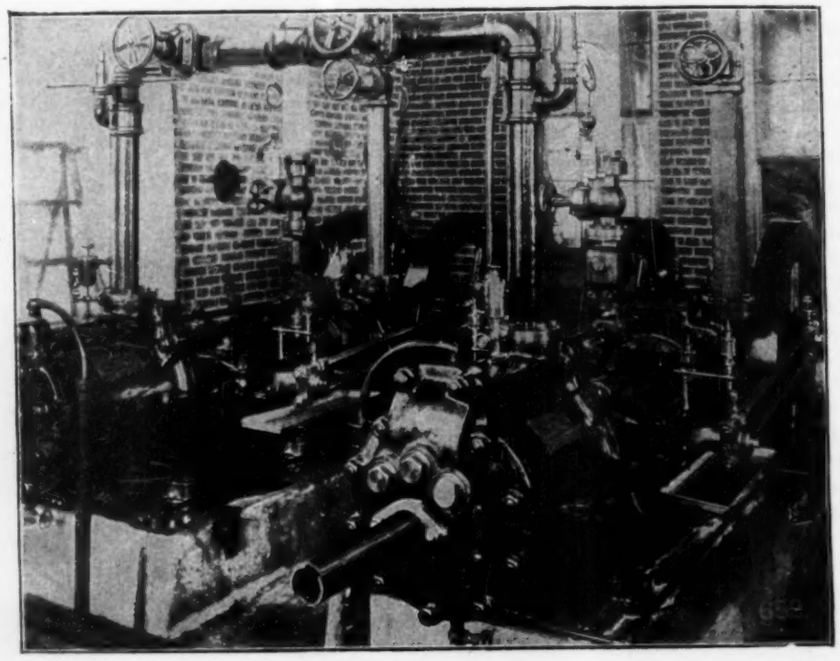
A series of twelve wells were driven along the low bank fronting the Anacosta river, says Compressed Air, about 50 or 60 feet from the water's edge. These were driven from 200 to 300 feet deep and include three wells with an 8-inch casing and five with 6-inch casing. In addition there are four other wells with a 2-inch casing scattered about the ground. Along the line thus established was buried an 8-inch cast iron water main with an elbow and riser at each well, clearly shown in the illustrations. From about midway of this row of wells a 12-inch cast-iron water pipe is run at right angles to a covered brick reservoir of a capacity of about 100,000 gallons, which is under the power house. The risers are about seven feet high, or just sufficient to produce head enough to carry the water over and into the reservoir. In all there are twelve wells using the Pohle Air Lift device with a 2-inch water pipe and a 1-inch air pipe inside of it. The air is forced down to the bottom through the 1-inch pipe and its only means of escape is through the larger pipe. In thus escaping the air raises the water with it.

Each of these Pohle pumps is guaranteed to lift 400,000 gallons of water in 24 hours and deliver this into the reservoir, provided the water level in the wells does not drop lower than 70 feet below the ground when pumping. This gives a total lift to the reservoir of 77 feet, with a submergence of 115 feet, or a total length of water pipe of 192 feet. It was found by experiment that each of these wells when pumped at the rate of 50 gallons per minute maintained a water level of 30 to 40 feet below the ground surface, and when standing idle the water rose to within 20 feet of the ground surface.

Air for pumping the wells is obtained from a duplicate plant consisting of two Class "A" steam actuated compressors of the Ingersoll-Sergeant "Straight Line" type with steam cylinders 12 inches in diameter and a 14-inch stroke and air cylinders 14¼ inches, also with a 14-inch stroke. One of these compressors is found sufficient to operate all the wells and the other is held in reserve. The compressed air passes off into a 42 x 96-inch high vertical air receiver, by which it is carried through a 3-inch pipe to a 2-inch main running parallel with the line of wells.



AIR LIFT WELLS AT THE GOVERNMENT HOSPITAL FOR THE INSANE, ANACOSTIA, D. C.



VIEW OF THE COMPRESSOR ROOM.

The first view illustrates the interior of the compressor room.

The second view shows the exterior of the power plant showing nine of the wells. This and other pictures clearly show the risers which are used to give a head sufficient to force the water into the reservoir, from which it is raised to the building by the usual steam pump.

WALKS ON THE WATER.

With the aid of remarkable shoes of his invention, Capt. Grossman, an army officer of Cologne, Germany, walked 100 miles on the surface of the water. He covered 20 miles in one day, towing his wife in a boat, and was greatly disappointed at the slow speed he made. His route was along the river Danube, from Linz to Vienna. Peasants along the banks of the river who beheld the strange spectacle fled in terror.

Automobiles across the Caucassus for carrying the Russian mails are to supplant the present transport by post horses, changing every ten miles. The route traverses the Dariel pass, 160 miles long.

COLD STOPS THE SETTING OF CEMENT.

The effect of cold is to stop the setting of cement, says Municipal Engineering. Most cements set very slowly, if at all, below 30 or 40 degrees. When the temperature is raised the cement sets, unless in the meantime the water has evaporated sufficiently to leave an insufficient quantity for the chemical action, so that the freezing of work laid in cement mortar usually has the effect simply of delaying the hardening of the mass. If too much water is used in the mortar, the expansion of the water in freezing may disintegrate the mortar by mechanical action of the ice in forming. Alternate freezing and thawing increases the danger of injury. Portland cement is seldom injured by freezing, but many natural cements are more or less injured, and mortar of natural cement is the more liable to disintegrate even under the best of conditions, if the temperature is long enough or often enough below the freezing point before it has had an opportunity to set. One method of aiding the setting of mortar is to delay the time of reaching the freezing point by heating the stone or brick, the sand, the cement and the water. Freezing may also be delayed by covering the work with straw or tarpaulins. The most common preventative

(SEE PAGE 106.)

is a solution of common salt for mixing. Add 1 per cent of salt to the water for every degree of temperature below freezing.

IMPROVE MEXICAN NATIONAL.

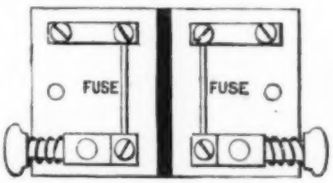
The Mexican National Railroad company has begun work transforming its entire system from a narrow-gauge to a standard-gauge line. The road is owned principally by American capitalists; has American managers and American railroad men in nearly all the responsible posts.

Plans have been submitted in London for a mono-rail transit line between Edinburg and Glasgow to make a speed of 117 miles an hour.

CONVENIENT CONNECTOR FOR TESTING.

A very simple and convenient connection for testing wires is illustrated in the London Electrical Review. It is intended for use on currents up to 10 amperes, and is easily constructed.

The square plunger is kept out a certain



distance by a spring, and on pressing the ebonite knob, the two holes come into line. By inserting the wire and releasing the knob, the spring causes a fair grip of the wire. The edges of the holes being well rounded, quite small wires can be clamped without being cut. A pair of fuses protect the terminals.

RESIN FOR SOLDERING.

An excellent method of preparing resin for soldering bright tin is given in the American Artisan as follows: Take 1 1-2 pounds of olive oil and 1 1-2 pounds of tallow and 12 ounces of pulverized resin. Mix these ingredients and let them boil up. When this mixture has become cool add 1 3-8 of a pint of water saturated with pulverized salamomoniac, stirring constantly.

The total German wheat crop of 1901 was 1,342,314 tons, or 35 per cent below that of the previous year. The crop of oats was an average one, the total yield being 7,053,153 tons, against 7,091,930 tons in 1900.

The Czar has authorized the city of St. Petersburg to issue $15,000,000 in bonds for municipal improvements, including the extension of the telephone system, the building of a dam near the Troizki bridge, and two new bridges over the Neva.

NOVEL TRICK WITH AN EGG.

You may cause an egg to force itself through the neck of a decanter into the decanter by this simple process. The decanter must be quite dry. Procure a hard-boiled egg and remove the shell.

First drop into the decanter a piece of lighted paper. As the flame dies out put one end of the egg into the neck of the bottle after the manner of a stopper. In a few moments the air will cool in the decanter and contract in volume, when the super-

ior pressure of the outer atmosphere will force the egg through the neck down into the decanter without breaking.

TO EQUIP RAILWAY TRAINS WITH TELEPHONES.

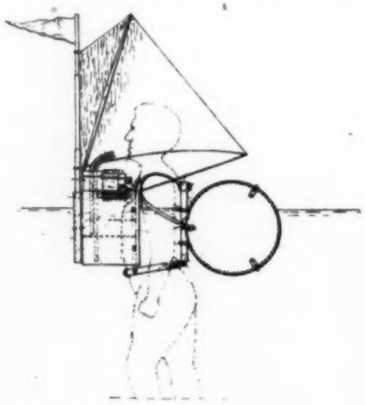
As a result of recent successful experiments it is intended to furnish all Illinois Central trains with telephonic equipment, the instruments to be placed in baggage cars of express trains and in engines or cabooses of freights. The company is elated with its experiments of telephoning over telegraph wires from a railroad engine on the southwestern branch of the road between Kankakee and Hempton, a distance of 26 miles. A number of stops were made between the two towns. A wire was strung from the engine to the telegraph line and telephone communication was established with the train dispatchers office at Kankakee without interfering with the regular business in the least.

British capitalists have formed a syndicate with $12,500,000, known as "The Charter Trust and Agency, limited," to develop South African mines.

The Boer war in two years has cost England $620,350,000.

SAILING LIFE PRESERVER.

While a person would hardly set out on a long voyage in this strange craft, he might be able to travel many miles and get to land in safety from a wreck. The preserver is a Swiss invention, and consists of an air tank to sustain the body in



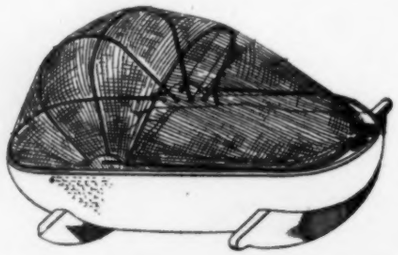
the water; also a tank with two compartments, one for fresh water and another for liquid food. The water and food are obtained by placing the mouth over ends of tubes, which extend to the bottom of the tanks. A small sail to propel the craft and a signal of distress complete the outfit. Strong straps and belts fasten the preserver to the body, which is sufficiently buoyant to keep the head and shoulder above water, even in cases of insensibility from exposure.

AMERICAN GAS PLANT IN MONTEREY.

An American has obtained concessions for the establishment of a modern gas plant for lighting and heating in Monterey, Mex. The plant will cost $125,000 American money. The entire equipment will be purchased in the United States.

SCREEN FOR CRADLES.

People in northern latitudes are not bothered much with flies these days, but an inventor in North Dakota is getting ready for warm weather. His device to



protect the baby consists of a frame which closely fits the edge of the cradle, with hoops arched to hold the screen which may be of wire or cloth.

DIVERS SUFFER INTENSE HUNGER.

A Fact Well Recognized, Which Scientists Cannot Explain.

The submarine divers are afflicted with an exaggerated sensation of hunger while under water is a fact well known to all of the profession but which cannot be explained by physicians or scientists. Capt. Conrad, the New Orleans diver, who died a few months ago as a result of work in the Maine wreck, once said:

"The moment I am fully submerged, my stomach gets busy with itself, and before I finish the trick, visions of succulent food so fill the water all about my glass peephole that I can scarcely tell a torpedo cable from a link of wienerwuerst. I am inclined to the opinion that the air and water pressure, especially the latter, turn a man's head just a trifle, and in some unexplainable way the attack takes the form of hunger."

MAGIC EGG TOP A MYSTERY.

A wonderful Easter novelty has appeared in the form of a magic egg top. There is something mysterious about the egg, says the Dry Goods Reporter. No one can ex-

plain just why it does as it does. It is the only top that spins on its side and on either end. It changes from a horizontal to a vertical position in a second, and for speed and endurance it beats anything ever invented. They are made of selected wood, have metal tips and are practically indestructible.

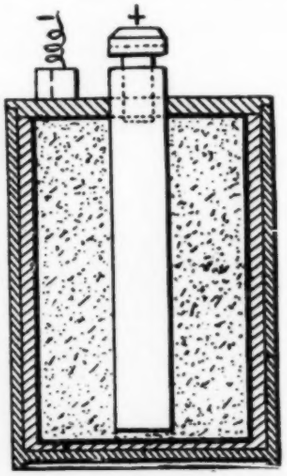
SOLDERING GALVANIZED IRON.

To solder galvanized iron, says the American Artisan, never use raw acid except on old iron. If the acid is first cut with zinc the operator will find no trouble in working on new galvanized iron.

The king of Italy has just passed an examination before the ministers' commission of police and has been licensed to operate a horseless carriage in the Eternal City.

A NEW BATTERY.

De Dion, a French expert, has invented a new battery which is described in the Motor Age. The positive electrode is a copper rod cylindrical in form located in the center of the cell. Surrounding the

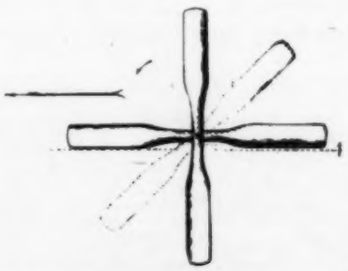


copper rod is a block of compressed oxide of copper which is obtained by precipitation, the precise method being the treating a soluble salt of copper, such as the sulphate, by an alkali, such as soda or potash. The oxide of copper thus obtained becomes readily covered when subjected to a simple pressure, which is not the case with copper scales unless foreign substances, which impair the strength of the battery, are used.

After inserting the copper electrode the compressed block is enclosed or wrapped in a thin piece of copper gauze, after which it is inserted in a cylindrical vessel of zinc, which constitutes the negative electrode and is provided with a terminal passing to the outside of the case The spaces in the copper gauze are completely filled with a solution of caustic potash which forms the electrolyte. After completion this battery may be hermetically sealed, as no gas is evolved from it.

TOY BOOMERANG.

An interesting toy has been invented by a man in Kansas. Two or more vanes are fastened as shown in the cut. These vanes are thin on one edge and thick on the



other. The boomerang is thrown by hand, by grasping one of the vanes. With sufficient practice and skill it should return to the thrower.

FOR THE MADAM.

WOMEN HATE GOOD-SIZED FEET.

Every one knows that a girl with good-sized feet a priori hates them. She makes a jest of them because there's no way of reducing their indescribable proportions, says the Shoe Trade Journal. At the same time, the truth is that a woman with a fairly large foot is better proportioned, more harmoniously constructed, and aesthetically speaking, a more beautiful creation than the woman whose foot is too short to support her body.

There is such a thing as a danger line of beauty, as Dr. Shoemaker says, and American feet often verge upon this and sometimes pass it. The American foot, especially the foot of the women of the south, descendants of generations of high-bred inactive forbears, is frequently too short for the height of the woman it supports. A woman of 5 feet 6 inches in height should have a foot 9 1-3 inches long. It should be slender and delicate, not thick and broad, and in the highest type the instep rises in a graceful swelling arch.

"It should be axiomatic," says the same writer, that nothing except face and hands can be so aristocratic as a well-dressed, shapely foot, and nothing so "plebeian as an ill-dressed clumsy one."

TO CLEAN WHITE WOODWORK.

White woodwork and furniture can be beautifully cleaned with whiting. Wring a flannel cloth from hot water, dip in whiting and rub well to remove all stains, then wash off the whiting with clean warm water and dry with a soft cloth. The rubbing strokes should always be with the grain of the wood.—What to Eat.

DELICIOUS WAY TO SERVE OYSTERS.

Cut the top crust off a loaf of bread. Scoop out the inside of both top and bottom, says the Fishing Gazette. Butter well the receptacle and cover thus formed, and put in over to brown. Have the oysters nicely creamed and hot, put them into the "box," cover and serve.

To serve: Remove cover, dip out the oysters and break a piece of the crust of the cover to go with each plate.

Silk stockings should be washed, inside out, in warm, not hot water, with plenty of lather. Rinse well, wring in a clean towel, and pull into shape to dry, but never ironing them.—Nat'l Laundry Journal.

A Lancashire, England, engineer who was having trouble with his boiler, removed 5,000 pounds of salt from it.

SCIENCE IN SHOVELS AND THEIR USE.

A recent issue of Engineering gives some interesting data of steps taken by the Bethlehem Steel Co. to reduce the cost of common labor employed in shoveling coal, ore, etc., and several highly trained specialists were engaged to study the problem. It was found that the time taken to insert a shovel into a pile was shorter if it were shoved into the top instead of the bottom of a pile. It also varied with material, taking longer for coke than sand, and, of course, with the man also, a powerful laborer taking 22 pounds at each shovelful, while the average was not more than 12 to 14 pounds.

As a result of this investigation, new sets of shovels, specially adapted to different kinds of work were used, and instead of sending a man out in the morning with a shovel, and allowing him to carry it all over the premises and use it indiscriminately on coke or ore, shovels of different sizes and shapes were used for different materials. The result of the study of this problem has been that the staff of common laborers, which averaged 400 or 500, at wages of $1.15 per day, has been cut down, and the work is now done by 85 men, who are paid at the rate of $1.85 per day.

BLOODCURDLING NAMES OF IRELAND.

A London newspaper writer points out in all seriousness that the "natural savagery" of the Irish peasantry in their struggle for home rule might be due to the blood-thirstiness of the names of their towns and country districts. Many of these places are named "Kil" something or another—"Kil" in Irish meaning church—such as Killarney, Killaloe, Kildare, Kilkenny, Kilrush, and Kilruddery. The Londoner, while traveling in Ireland, was considerably startled on hearing at a railway station the following conversation between two wild-looking peasants.

"I'm just afther bein' over to Kilpatrick," said one.

"An' I," replied the other, "am afther being over to Kilmary."

"What murderers they are!" thought the Englishman. "And to think they talk of their assassinations so publicly!"

"And where are you goin' now, Jim?" asked assassin No. 1.

"I'm goin' home to Kilmore," was No. 2's reply. The Englishman's blood curdled.

"Kilmore is it?" said the other. "Faix, you'd bether be comin' wid me to Kilumaule."

The frightened Englishman went no farther on his journey. He waited at the station for the next train back to Dublin, and returned to England by the first boat.

AN IDEAL DUSTLESS SWEEPER.

A dustless sweeper that ought to have a place in every home is herewith illustrated. It is a hygienic damp broom that does away with all rising of the dust and

sprinkling of sawdust. It sweeps clean and destroys all kinds of germs. It is distinctly antiseptic and never gets sticky. The broom may frequently be found on bargain counters at a very low price.

SCHEME TO PREVENT RAILROAD ACCIDENTS.

The numerous railroad collisions the past few weeks have set people to asking what can be done to prevent them. The Electrical Review says:

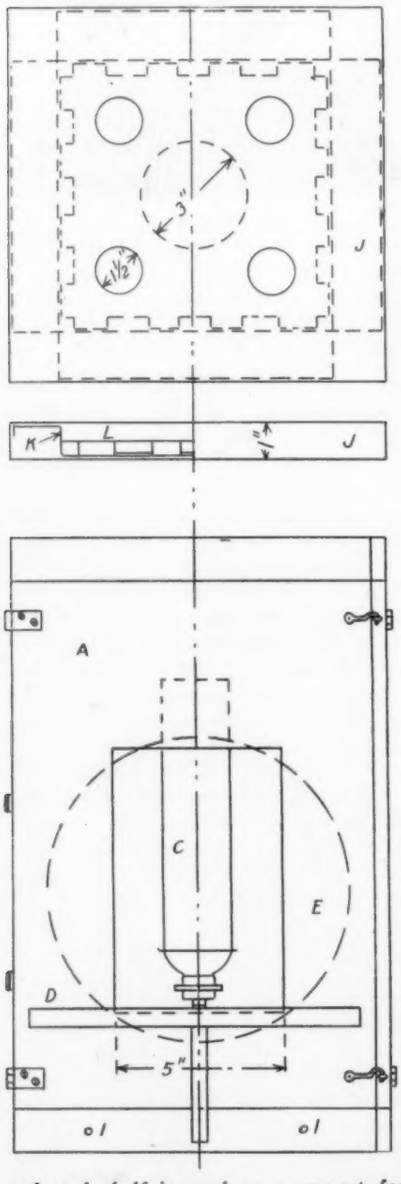
On the important electric lines recently constructed in the north of Italy, the track and working conductor are divided into sections, and each train as it goes along leaves the section through which it has just passed dead behind it. For this reason it is impossible for rear-end collisions to occur, since no train can enter the block which another has just left until the other has gone ahead into the next following block. Such a system would seem on a double-track railroad to make an accident by collision practically impossible.

The automatic feature of this apparatus, however, introduces as many elements of danger as it suppresses. It is not considered good practice either in railway or marine operation to trust too much to automatic devices of any character, but rather to supplement the operation of such apparatus by human intelligence, and vice versa. It is not likely that railroads, in this country at any rate, would trust absolutely an automatic block signal system or install such a device in place of the present method of blocking, signaling and despatching. But there is no reason whatever why the interlocking and automatic principles of the switches and signals now employed on first-class railways might not, with electrical equipment, be extended a step further so as to deprive a section on which danger signals were set of power.

SIMPLE GASLIGHT PRINTING APPARATUS.

Device Easily Made for Exposing and Recording Exposures.

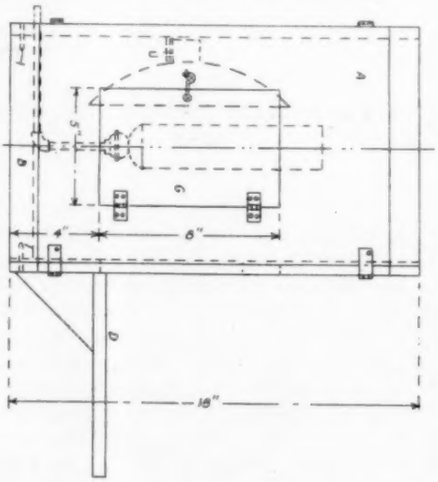
With the aid of a Welsbach burner and a graduated shelf users of gaslight paper may find an accurate and convenient method of exposing and recording the exposure. The Welsbach burner is enclosed in a box to prevent the light from shining where it is not wanted, says A. L. Fitch in the Photo-Beacon for January, and the



graduated shelf is used as a support for the printing frame.

The box A is made of ½-inch board, rabbeted at the corners, and if hinged, as shown, it may be knocked down and folded to occupy a little over two inches in thickness. The strips on the ends are to prevent warping and may be about one inch wide. The bottom B is of ⅞-inch stuff, made to fit inside the box and held in place by four headless wire nails, I, driven into the edges and fitting into corresponding holes in the box. The burner C is screwed to the top of a ⅛-inch nipple, connected, as shown, at such a height as to be opposite the center of the opening in front of box, and to the end of pipe, which projects through the back of box, a rubber hose from a convenient gas fixture is attached. If the apparatus is to be used always in the same place a good plan is to insert one of the cocks made for the purpose between a gas bracket and the pipe projecting from the wall, thus enabling the operator to slip the hose on or off without interfering with the light in the room, which will not be needed during printing, however, as sufficient will come from the box. The manner of securing the pipe to botton B may be by staples or other convenient way.

The shelf D has lines an inch apart numbered as shown and measured from the burner. It has a bracket underenath and is held in place by two screw-eyes H, which slip over wire nails as shown. By lifting the shelf slightly it may be removed. The opening through which the light comes is 5 by 8 inches and is large



enough for an 8 by 10 print if not placed too near.

The reflector E is one of the silvered glass kind that may be had for 25 cents and is held in place by a large screw-eye F screwed into the back of box and through the eye of which is put the pin on back of reflector. The reflector is not necessary but adds to the power of the apparatus. The door G is more of a convenience and may be left off if not wanted.

The cover, composed of three pieces of tin, J, K, and L, is just large enough to slip over the top of the box. The piece J is flat turned down around the edges and has the four 1½-inch holes. K is notched at the corners and bent to fit closely inside J around the outside, but drops down in the center and has the 3-in. hole. It is better to make K first.

The piece L which fits between J and K is cut into around the edge at intervals of one inch, and alternately turned down and left straight. To prevent the light from being reflected through the openings it is a good plan to blacken the inside with drop black in japan, thinned with turpentine. A tin lining to box will help reflect some light and also protect the wood from the heat of flame. The writer has had the best results with the Yusea mantle, as the light is so much stronger than some others, but there is a burner on the market which uses gasoline vapor under pressure, and strong as the gas light. In this connection the following table showing the relative exposure necessary at different distances from the light may be found useful, always remembering that the intensity of the light varies at the square of its distance.

Inches.	6	7	8	9	10	11	12	13	14
6	1.	1.4	1.8	2.2	2.8	3.4	4.0	4.7	5.4
7	.73	1.	1.3	1.7	2.0	2.5	2.9	3.4	4.0
8	.56	.77	1.	1.3	1.6	1.9	2.3	2.6	3.1
9	.44	.60	.79	1.	1.2	1.5	1.8	2.1	2.4
10	.36	.49	.64	.81	1.	1.2	1.4	1.6	1.9
11	.30	.40	.53	.67	.83	1.	1.2	1.4	1.6
12	.25	.34	.44	.56	.70	.84	1.	1.2	1.4
13	.21	.29	.38	.48	.60	.72	.85	1.	1.2
14	.18	.25	.33	.41	.51	.62	.73	.86	1.

When once the correct exposure for any negative with any paper is found, it is a good plan to make a note of it on the envelope or elsewhere for future reference.

Mr. Fitch claims that more recently experiments have convinced him that a far more even illumination may be obtained by using two burners side by side, without a reflector.

The "hotel physician" has existed for years in the leading hotels and his income is handsome. Now the "hotel chaplain" has appeared. The Rev. H. M. Warren, D. D., of New York, is the first to hold this office and his sign as "hotel chaplain" is posted in one of the leading hostelries of the metropolis.

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TOM PRATT.

Firin'? Yes, though my hair is white,
For my eyesight's good and clear;
I can see ahead on the track at night
As far as the engineer.

You're new on the road? Of course, that's so.
No need fur to tell me that,
Fur all the boys around here know
The story of old Tom Pratt.

I was young as you when I got my run,
An' as full of snap an' go,
An' I felt that life was well begun
When I'd see the fire glow.

An' think she was makin' steam fur me,
That had wiped an' had rustled coal,
That I wasn't the servant of 73,
But her life an' her brains an' soul.

At the end of a run I would hurry to get
Washed up, an' my good clothes on,
Fur the wife, she was likely to worry an' fret,
Bein' lonesome when I was gone.

An' the baby! It seemed like he growed two feet,
An' got a new tooth every day,
An' he looked so purty an' changed an' sweet
Whenever I'd been away.

What got wrong with the kid before that trip
I never made out just right;
He was awful pale ,an' he drooped his lip
When I kissed him an' says "Good-night."

An' in front of the gauge, an' before the glass,
Across in the firemen's place,
In the flarin' lights of the trains we'd pass,
I could see that little face.

I don't say I had a presentiment,
An' I don't say what I knew,
But a look in the picture I saw there went
To my heart an' I just felt blue.

An' when the orders was brought ahed,
His face was before me still,
I never took in what the "con" had said,
But just says, "All right, Bill."

We was makin' time, an' I had her wide,
An' we buzzed along the track,
An' the sparks was lightin' the canyon side
Fur a mile an' better back.

The fireman says, "We're a-gittin' there,
You're my kind of an engineer;
But, Tom, just wouldn't it raise your hair
If we'd meet No. 9 right here?"

He'd just said the words and we'd turned a curve,
An' I grabbed the lever an' air,
Fr a shinin' out with never a swerve
Was a headlight, there! right there!

I stayed in the cab an' felt it all,
The crash an' the sickening grind,
I heard the butchered cattle call
As they died in the cars behind.

I saw—but, no—I can't tell it yet—
It was twenty years ago;
But in twenty more I could not forget
That sight ahead, I know.

For No. 9 was a passenger train,
With a crowd from a holiday,
Comin' up with orders straight an' plain,
"You have got a clear right of way."

Discharged? Well, what could the company do?
Of course, I expected that,
They were more than good, between me an' you,
In their dealin' with old Tom Pratt.

It was all the orders I didn't hear,
An' didn't make out just right;
It was all the fault of a blindin' tear
Fur a boy that died that night.

They gave me a job in a year or two,
As a fireman in the yard;
There was nothin' else fur a man to do,
Though the drop an' the work was hard.

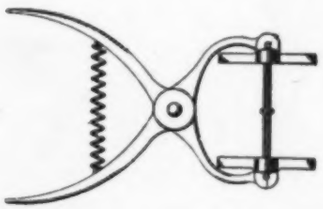
An' little boys that was kids knee high
When they gave me the 73,
Works up to their runs like you, while I
Am a-doin' just what you see.

Injustice! Not much; it was only right;
For a man whose brain ain't clear,
Or with dyin' babies, like mine that night,
Ain't fit fur an engineer.

—Portland Oregonian.

A SIMPLE SQUEEZING DEVICE.

Among recent patents granted is the one illustrated. It is a form of pincers with



adjustable gauge, which can be set so the pressure will cease at the same points each time.

A lady was looking for her husband and inquired anxiously of a housemaid: "Do you happen to know anything of your master's whereabouts?"

"I'm not sure, mum," replied the careful domestic, "but I think they're in the wash."
—Pathfinder.

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FOR SALE—Five sets of 1-12 h. p. electric motor castings, for $1.00 per set. Photo for stamp. Roy A. Crihfield, Lincoln, Ill.

ENGINEER'S LICENSE—Mechanics, Engineers, firemen, electricians, etc., 40 page pamphlet containing questions asked by Examing Board of Engineers; sent free. Geo. A. Zeller, Publisher, Room 592, 18 S. 4th St., St. Louis, Mo.

FOR SALE—Job lot new electrical goods given us to sell; list for stamp. We handle everything electrical and at lowest prices. Stamp for catalogue. Dept. N., T. Binford Electric Works, 994 Washington Blvd., Chicago, Ill.

POSITIONS WANTED.

CUBA—I will locate in Havana this year and want a general representation for machinery, tools and hardware specialties; well acquainted with languages and customs; references; bond if necessary. C. S. Lawrence, Box 814, New Orleans, La.

ENGLAND—Can accept the agency for a few lines of American manufacture in British Isles and Continental Europe. Can furnish references. Montague Cohen, 39 Paradise street, Liverpool, Eng.

MILLER—Millowners who are in need of a first-class roller miller may find it to their advantage to correspond with me; 28 years experience. 647 Lorain street, Cleveland, O.

POSITION IN ELEVATOR—Have had ten years experience in handling grain. Have run elevator in connection with mill. Understand mixing and grading. M. A. Johnson, Stewardson, Ill.

ASSAYER AND CHEMIST—A graduate of the Colorado School of Mines, with eight years constant practice at ore-sampling and chlorination plants in Colorado. C. M. P., Salt Lake City, Utah.

METAL MINE MANAGER AND SUPERINtendent—Twenty years Western and Mexican experience; good assayer; mill and cyanide man. P. O. Box 99, Steeple Rock, N. M.

SALESMAN—Young man 23, now assistant manager in sales and shipping department of large Ohio manufacturing concern, desires position in the West. Competent to handle advertising and printing. Reference, my present employers. F. W. Rea, Canton, O.

TRAVELING SALESMAN—Experienced in selling agricultural implements and hardware, desires position with responsible manufacturer. Box 33, Archer, O.

ENGINEER—Eight years experience in flour mills and manufacturing plants. Corliss engines a specialty. Box 302, Loudonville, O.

MINING ENGINEER—Scientific and practical training; six years experience; mine and surface surveying, assaying; accurate draughtsman. Address Engineer, 428 Yamhill street, Portland, Ore.

MINE MANAGER OR FOREMAN—14 years experience in gold, silver and copper mining; thoroughly understand all kinds of quartz mining machinery. C. C. Edwards, 127 E. Bennett avenue, Cripple Creek, Col.

BUSINESS CHANCES.

FOR SALE OR EXCHANGE—122 acres all plow land in McHenry county; well fenced; good well and windmill; price $50 per acre. Address 400, Popular Mechanics.

FOR SALE—Locomobile runabout, nearly new, $400. Address 402 Popular Mechanics.

FOR SALE—Steam auto truck; cost $5000; will sell for $300. 354 Dayton street, Chicago, Ill.

WANTED—Manager to take charge of warerooms and office to be opened in Springfield, Ill., to further business interests of old manufacturing concern. Salary $125; applicant must have $800 cash.

WHAT IS COMING.

Did you ever eat any fish sausage? They are now making sausages of dog-fish. So many dog-fish are being caught in America that the fish commission had to call a halt. Next week's Popular Mechanics will tell about it.

In the year 1 chickens were raised; it will surprise you next week when you read that people knew nearly as much about the poultry business then as they do now, although they have had two thousand years to learn in.

Down in "Arkansaw" they use the rights-of-way wires along railroads for telephones and can talk over them a distance of 100 miles. It's in the next issue.

No longer is there cause for sailors to die of thirst for fresh water. Salt water is now easily converted into fresh water. We will tell all about it next week.

Would you like to fly? We can't enable you to do exactly that, but we can tell you how to do the next thing to it. It is skating with sails. Read about how to make and use the sails.

France's submarine torpedo boat that sneaked about and planted deadly torpedos to the bottom of war vessels without being detected is no longer of any use. An American has built a machine that will always tell when these kind of boats are coming. France crowed too soon.

In Germany they have a monument to the potato; Emperor William's new yacht is a marvel; it is the simplest thing in the world to enlarge photographs if you have a camera; the first locomotive was built 100 years ago; the inventor of the bicycle died in poverty. Of course you want to know all about all of these things and Popular Mechanics will explain them, and lots more, next week. "It is written so you can understand it."

FOR SALE OR EXCHANGE—$8,000 stock fine clothing and men's furnishings. Address 401, Popular Mechanics.

FOR SALE—The leading implement and vehicle business in good live town. Stock invoices about $2,800. Sickness reason for selling. C. W. Porter, Fairfield, Neb.

FOR SALE—Stock of hardware, stoves, buggies and implements. Good paying business; established trade. W. V. Britton, Hudson, Ind.

WANTED—Millers who are interested in mill improvements to send me their address. Leslie R. Veatch, Mt. Sterling, Ky.

WANTED—Mill from 150 to 300 barrels' capacity, in a good location in Minnesota or North or South Dakota. Address Room 41, 116 Broad street, New York, N. Y.

FOR SALE—An India Rubber plantation in Mexico; more than 16,300 acres, with 1,000,000 producing trees; river navigation to seaport. It is now a money-making proposition. E. J. Fraser, 522 Emporium building, San Francisco, Cal.

FOR SALE—Copper, Zinc and Iron Mines in Norway; will make liberal arrangements with capitalists to develop and work. None but principals dealt with. John M. Thrane, Bergen, Norway. Telegraph address, Thrane.

WANED—A free milling gold proposition; one with a well defined vein; either a prospect or a partially developed mine; no brokers recognized. Box 3452, Boston, Mass.

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WHY NOT try sign painting? No experience required; no fraud; samples, instructions, etc., 10 cents. City Sign Co., Springfield, O.

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